

misses, in a book meant for medical men and travellers, are good, plain descriptions and diagrams giving the names and explaining the relations of all those parts of the snake's skeleton and integument that are of applied value in classification. Here there are descriptions and figures, but they do not explain *all* the terms employed in the specific and generic diagnoses; moreover, some of the terms used are not those commonly current, and some do not correspond in text and figure. Thus the well-known quadrate bone is referred to as the tympanic; and the shields which in the text are called, in accordance with the authorised British version, internasal, prefrontal, frontal, and parietal, appear in the figure under other names. Seeing that the differentiation of species, and even of genera, largely depends upon scale-characters, this is hardly a matter of little moment.

The second part, which treats of snake-venoms, describes the methods of collecting venom and the chemical composition of the secretion, and gives an account of the way in which in the laboratory the various constituents of the venom act upon the blood and tissues. The gross effects of cobra-bite and viper-bite are also contrasted. The author naturally draws largely on his own experiments, but the work of other investigators is duly considered. It is rather surprising, however, not to find any mention whatever of D. D. Cunningham, who for many years was in India the observed of all observers in this field.

The third part brings us to the cream of the subject, namely, the æquisition of immunity against snake-venom and the use of the serum of immunised animals as a cure for snake-bite. This subject is so largely the author's own that criticism can only be offered with deference. But, considering merely the way in which the matter is represented in the book under review, the author appears to rely rather too much on his own large experience with cobra-venom, and also to be hardly consistent; for although he seems to adhere to the untenable opinion that neurotoxin is the essential toxic constituent of *all* venoms, whether colubrine or viperine, he allows that cobra-antivenin is of no avail against what, by a strain of language, he calls the "local" effects of viperine venom, and he concedes the practical point that an antivenin of general efficacy can only be obtained from an animal that has been immunised against *both* kinds of venom, colubrine and viperine.

The only other part of the book that requires notice is that concerned with the venoms of animals other than snakes. Here we find many interesting fragments of information about the venom of polyps, sea-urchins, arthropods, molluscs, fishes, and amphibia. The venomous Mexican lizard, *Heloderma*, and the spur and femoral gland of *Ornithorhynchus* are also remembered, but, strange to tell, the dreadful sting-rays, the notorious jelly-fishes, and the molluscan *Toxiglossa* are quite forgotten.

As to Mr. Austen's translation, it is as near as possible perfect, being wonderfully faithful to the original, and yet, so far as technical terms do not interfere, good English. In the case of some of the technical terms, however, Mr. Austen's unflinching fidelity sometimes goes near to make the reader wince.

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There are expressions, such as "gingival fold," "ergastoplasmic venogen," "sanguinolent serosity," "laccate," "chloridate," "asporogenous," to which even the hardest-mouthed jargonmonger will object.

THE SCOTTISH LAKE SURVEY.

Bathymetrical Survey of the Fresh-water Lochs of Scotland. Under the Direction of Sir John Murray, K.C.B., F.R.S., and Laurence Pullar. Pp. viii+288; maps and plates. (London: Royal Geographical Society, and Edward Stanford, 1908.)

IN some countries it appears so natural that the national surveys should present a complete delineation of the solid surface of the land that the accident of certain hollows being filled with water does not excuse the surveyor from continuing his contour lines across the submerged slopes. With us, however, until the Survey Department was supplied with the necessary data by private investigators, no sub-lacustrine contour lines appeared even on maps of the largest scale, and large surfaces of paper remained blank save for the artistically graduated lines which indicated the difference between a water and a land surface. Most of the English lakes were surveyed in 1893 and 1894, and the contour lines appear on the later editions of the six-inch maps, with due acknowledgment of the source whence they were derived.

The volume now before us completes the preliminary publication of the survey of the lakes of Scotland undertaken by Sir John Murray and Mr. Pullar in 1896, and now brought very near completion. It represents an immense amount of work of national importance carried out at the personal cost of the authors, and its very magnitude makes it impossible to give any serviceable summary here of the additions to limnology it contains. Eighteen papers appeared in the *Geographical Journal* between 1900 and 1908, illustrated by bathymetrical maps of 213 fresh-water lochs, and this volume, published separately by the Royal Geographical Society, gives particulars and bathymetrical maps of a further series of 349 lochs, making a total of 562 surveyed and described. The number is so great that we cannot help regretting that it has not been made complete, but the rule appears to have been that no steps were taken to survey those lochs on which a boat was not available. In this way some sheets of water of considerable size and great interest have been left unsounded, a fact the more regrettable because difficulties due to sporting rights in some of the nearly inaccessible valleys in the heart of the great deer forests may prove insuperable to less known investigators in the future, while the high distinction of Sir John Murray's name might possibly have smoothed a way in the course of his great survey.

Apart from this, the record of the Loch Survey is one that Sir John Murray, Mr. Pullar and their numerous assistants may well be proud of. How great a body of work it represents may in part be gathered from the complete index, which includes all lakes described here and in the articles which have appeared in the *Geographical Journal*; but a mass of additional

material bearing on the physics and biology of the waters has still to be published.

The bathymetry of the lake-basins was determined by series of close soundings in lines transverse to the long axis, and the scale of the maps is sufficiently large (3 inches to 1 mile) to allow of all the soundings being represented in figures as well as by contour lines. We think that a longitudinal line of soundings along the axis of maximum depth would have been a useful addition in all cases, and a valuable check on the transverse series. Supplementary soundings would also have been useful in many places where the exceptional run of the contours suggests some unusual configuration. Such additional lines have been run on some of the lochs, and the maps of these inspire a more complete confidence as to detail than do the others. We should have liked to see some larger-scale surveys of such individual features as the sub-lacustrine slopes of delta fans, scree, steep rocky shores, and the transition belt between the steep sides and flat floors of many of the basins.

The sounding of the large area of fresh water which fell between the two stools of the Admiralty and the Ordnance surveys is a splendid example of public-spirited private enterprise undertaking and carrying through work which should have been included in the routine of a Government department. It is, happily, not the only case in which the collective shortcomings of the nation in matters affecting the advancement of scientific knowledge have been made good by individual effort and at private expense. When the right men are at the head of such an investigation, and their labours are not trammelled by the want of means, we are of opinion that better work can be done at a smaller outlay than if the operations were conducted by an official department or under the auspices of a committee of many specialists on different subjects; but when the right men are not to be found the lack of Government interest in the completion of our knowledge of our own land and its resources may lead to unhappy consequences. It is fortunate, indeed, that Sir John Murray and Mr. Pullar have had both the will and the power to carry out the work, which, when completed by the publication of the additional material already collected, will form a noble monument to the memory of the late Mr. Fred Pullar, to whose energetic assistance the early stages of the research were so much indebted.

H. R. M.

THE OLD AND THE NEW MECHANICS.

- (1) *A First Dynamics*. By C. S. Jackson and W. M. Roberts. Edited by W. J. Greenstreet. Pp. viii+412. (London: J. M. Dent and Co., 1909.) Price 5s.
- (2) *Elementary Mechanics*. By Prof. C. M. Jessop and Dr. T. H. Havelock. Pp. viii+277. (London: George Bell and Sons, 1909.) Price 4s. 6d.

(1) SO many new series of mathematical school-books have appeared during the last few years that the present series has remained almost unnoticed. This is the more remarkable in view of the wide reputation of the editor, Mr. Greenstreet, and also of

the fact that the contributors are also mostly well-known authorities in the mathematical teaching world. Messrs. Jackson and Roberts have fully justified the existence of their book by the amount of freshness and originality they have put into it, and particularly by the extent they have treated the subject from a common-sense, practical point of view. As the authors point out in the preface, there have been in the past two classes of book in which the relations between force, matter, and motion are dealt with. There has been, first, the book on applied mechanics, in which the principal object has perhaps been to describe machines, and there has next been the "academic" book, in which dynamics might perhaps better be described as "dogmatics," the most prominent feature of which has been a collection of exercises in algebra.

It has been the object of the present authors to make the principles of dynamics the prominent feature of their book, and to illustrate them by applications to phenomena of everyday life rather than by algebraic drill. In this they have been very successful, so far as can be judged without an extended trial of the book in the class-room.

The main crux in writing a book on dynamics is the question of units. Shall the author use poundals and please one class of teachers, or shall he use slugs and be commended by another section? It seems to have been generally forgotten that there is a third alternative which still allows those who wish to do so to replace Newton's "proportional" by "equal" in the laws of motion. That alternative is to take the gee (g) as unit of acceleration, and write force in lbs. wt. = mass in pounds and acceleration in gees; and if any writer chose to champion the claims of the gee, he could point to the fact that the foot, if defined by the length of the seconds pendulum, is really a gravitation unit of length.

Messrs. Jackson and Roberts, while discussing the two generally recognised systems, adopt the more rational plan of basing their treatment on the proportion:—

$$\frac{\text{force}}{\text{weight}} = \frac{\text{acceleration}}{g}.$$

It has been popularly supposed that this plan is theoretically good, but how would the equations of motion of complicated systems be written? Now in Mr. Jackson's hands the equations all look delightfully simple; not only is there no more difficulty than occurs somewhere in every system, but *it is very easy to see if the results written down are correct in their dimensions*. The suppression of constant multipliers in physical equations does not always conduce to simplicity; it more often causes confusion, especially in connection with electrostatic and electromagnetic units, and also in hydrodynamics, where problems of discontinuous motion are solved for jets of one particular breadth (generally π) with one particular velocity, and the solution appears inapplicable to other jets differing in size and velocity. A little doubt may occur as to whether momentum should be defined as Wv/g , as Mr. Jackson does, or simply as Wv ; but this is a matter in which experience will indicate the wisest choice.